[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 33 and 35

[Docket No. FAA-2015-4220; **Special Conditions No. 33-017-SC]**

Special Conditions: CFM International, LEAP-1B Engine Models; Incorporation of Woven Composite Fan Blades

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions; request for comments.

SUMMARY: These special conditions are issued for the CFM International (CFM), LEAP-1B engine models. This engine model will have a novel or unusual design feature associated with the engine: woven composite fan blades. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

DATES: The effective date of these special conditions is **[*Insert Date 30 days after date of publication in the Federal Register*]*.***

We must receive your comments by **[*Insert Date 15 days after date of publication in the Federal Register*]*.***

ADDRESSES: Send comments identified by docket number FAA-2015-4220 using any of the following methods:

- Federal eRegulations Portal: Go to http://www.regulations.gov and follow the online instructions for sending your comments electronically.
- Mail: Send comments to Docket Operations, M-30, U.S. Department of Transportation (DOT), 1200 New Jersey Avenue, SE, Room W12-140, West Building Ground Floor, Washington, D.C., 20590-0001.
- Hand Delivery or Courier: Take comments to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE, Washington, D.C., between 9 a.m. and 5 p.m., Monday through Friday, except federal holidays.
- Fax: Fax comments to Docket Operations at 202-493-2251.

Privacy*:* The FAA will post all comments it receives, without change, to http://www.regulations.gov, including any personal information the commenter provides. Using the search function of the docket web site, anyone can find and read the electronic form of all comments received into any FAA docket, including the name of the individual sending the comment (or signing the comment for an association, business, labor union, etc.). DOT's complete Privacy Act Statement can be found in the Federal Register published on April 11, 2000 (65 FR 19477-19478), as well as at http://DocketsInfo.dot.gov.

Docket: Background documents or comments received may be read at http://www.regulations.gov at any time. Follow the online instructions for accessing the docket or go to the Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE, Washington, D.C., between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Alan Strom, Federal Aviation Administration Engine and Propeller Directorate, Aircraft Certification Service, ANE-112, 12 New England Executive Park, Burlington, Massachusetts, 01803-5213; telephone (781) 238-7143; fax (781) 238-7199; e-mail alan.strom@faa.gov.

SUPPLEMENTARY INFORMATION:

Comment History

The FAA has determined, in accordance with 5 U.S.C. 553(b)(3)(B) and 553(d)(3), that notice and opportunity for prior public comment heron are unnecessary because the substance of these special conditions was subject to the public comment process in a prior instance, with no substantive comments received. The FAA therefore finds that good cause exists for making these special conditions effective upon issuance.

Special Condition No.	Company / Airplane Model
33-14-02-SC	CFM / LEAP-1A CFM / LEAP-1C

Comments Invited

We invite interested people to participate in this rulemaking by sending written comments, data, or views. The agency also invites comments relating to the economic, environmental, energy, or federalism impacts that might result from adopting the proposals in this document. The most helpful comments reference a specific portion of the special conditions, explain the reason for any recommended change, and include supporting data. To ensure the docket does not contain duplicate comments, commenters should send only one copy of written comments, or if comments are filed electronically, commenters should submit only one time.

We will file in the docket all comments we receive, as well as a report summarizing each substantive public contact with FAA personnel concerning this action. Before acting on this action, we will consider all comments we receive on or before the closing date for comments. We will consider comments filed after the comment period has closed if it is possible to do so without incurring expense or delay. We may change these special conditions based on the comments we receive.

Background

On May 9, 2013, CFM International (CFM) applied for a type certificate for their new LEAP-1B engine model(s). The high-bypass-ratio LEAP-1B engine models incorporate woven composite fan blades, a novel or unusual design feature. These fan blades have:

- Significant material property characteristic differences from conventional, single-load path, metallic fan blades.

- Multiple load path feature and/or crack arresting feature capabilities that, during blade life, may prevent delamination, crack propagation, and/or blade failure.

Because of their novel or unusual design, these fan blades:

- Require additional airworthiness standards for LEAP-1B engine type certification, to account for material property and failure mode differences with conventional fan blades. The applicable airworthiness regulations that exist do not contain appropriate safety standards for these new blades.

- May allow for application of different fan blade containment requirements, if CFM demonstrates improved load path features and/or crack arresting feature capabilities of the new blade design, below the inner annulus flow path line.

Type Certification Basis

Under the provisions of Title 14, Code of Federal Regulations (14 CFR) 21.17, CFM must show that the LEAP-1B engine models meet the applicable provisions of the applicable regulations in effect on the date of application, except as detailed in paragraph 21.101(b) and paragraph 21.101(c).

The FAA has determined the following certification basis for the LEAP-1B engine models: 14 CFR part 33, ‘‘Airworthiness Standards: Aircraft Engines,’’ dated February 1, 1965, with Amendments 33–1 through 33–33, dated September 20, 2012.

If the FAA finds that the regulations in effect on the date of the application for the change do not provide adequate or appropriate safety standards for the LEAP-1B engine model(s) because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

Special conditions are initially applicable to the engine model(s) for which they are issued. Should the type certificate for that engine model be amended later to include any other engine model(s) that incorporates the same novel or unusual design feature, the special conditions would also apply to the other engine model(s) under § 21.101.

In addition to complying with the applicable product airworthiness regulations and special conditions, the LEAP-1B engine model(s) must comply with the fuel venting and exhaust emission requirements of 14 CFR Part 34.

The FAA issues special conditions, as defined in 14 CFR 11.19, in accordance with § 11.38, and they become part of the type certification basis under § 21.17(a)(2).

Novel or Unusual Design Features

The LEAP-1B engine models incorporate a novel or unusual design feature: woven composite fan blades.

Discussion

As discussed in the summary section, the LEAP-1B engine model(s) incorporate woven composite fan blades instead of conventional, single-load path, metallic fan blades, which is a novel or unusual design feature for aircraft engines. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature.

Applicability

As discussed above, these special conditions are applicable to the LEAP-1B engine model(s). Should CFM apply at a later date for a change to the type certificate to include another model on the same type certificate incorporating the same novel or unusual design feature, the special conditions would apply to that model as well.

Conclusion

This action affects only certain novel or unusual design features on LEAP-1B models of engine(s). It is not a rule of general applicability and applies only to CFM, who requested FAA approval of this engine feature.

List of Subjects in 14 CFR Parts 33 and 35

Aircraft, Engines, Aviation safety, Reporting and recordkeeping requirements.

The authority citation for these special conditions is as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701, 44702, 44704.

The Special Conditions

Accordingly, pursuant to the authority delegated to me by the Administrator, the following special conditions are issued as part of the type certification basis for CFM LEAP-1B engine model(s).

Special Conditions: CFM International LEAP–1B Model Turbofan Engines

Accordingly, the Federal Aviation Administration (FAA) issues the following special conditions as part of the type certification basis for the CFM, LEAP–1B turbofan engines.

Part 33, Requirements. In addition to the airworthiness standards in 14 CFR Part 33, effective February 1, 1965, with Amendments 33-1 through 33-33 applicable to the CFM, LEAP-1B engine models:

(a) Conduct an engine fan blade containment test with the fan blade failing at the inner annulus flow path line instead of at the outermost retention groove.

(b) Substantiate by test and analysis, or other methods acceptable to the FAA, that a fan disk and fan blade retention system with minimum material properties can withstand, without failure, a centrifugal load equal to two times the maximum load the retention system could experience within approved engine operating limitations. The fan blade retention system includes the portion of the fan blade from the inner annulus flow path line inward to the blade dovetail, the blade retention components, and the fan disk and fan blade attachment features.

(c) Using a procedure approved by the FAA, establish an operating limitation that specifies the maximum allowable number of start-stop stress cycles for the fan blade retention system. The life evaluation must include the combined effects of high-cycle and low-cycle fatigue. If the operating limitation is less than 100,000 cycles, that limitation must be specified in Chapter 5 of the Engine Manual Airworthiness Limitation Section. The procedure used to establish the maximum allowable number of start-stop stress cycles for the fan blade retention system will incorporate the integrity requirements in paragraphs (c)(1), (c)(2), and (c)(3) of these special conditions for the fan blade retention system.

(1) An engineering plan, which establishes and maintains that the combinations of loads, material properties, environmental influences, and operating conditions, including the effects of parts influencing these parameters, are well known or predictable through validated analysis, test, or service experience.

(2) A manufacturing plan that identifies the specific manufacturing constraints necessary to consistently produce the fan blade retention system with the attributes required by the engineering plan.

(3) A service management plan that defines in-service processes for maintenance and repair of the fan blade retention system, which will maintain attributes consistent with those required by the engineering plan.

(d) Substantiate by test and analysis, or other methods acceptable to the FAA, that the blade design below the inner annulus flow path line provides multiple load paths and/or crack arresting features that prevent delamination or crack propagation to blade failure during the life of the blade.

(e) Substantiate that during the service life of the engine, the total probability of an individual blade retention system failure resulting from all possible causes, as defined in § 33.75, will be extremely improbable with a cumulative calculated probability of failure of less than 10E-9 per engine flight hour.

(f) Substantiate by test or analysis that not only will the engine continue to meet the requirements of § 33.75 following a lightning strike on the composite fan blade structure, but that the lightning strike will not cause damage to the fan blades that would prevent continued safe operation of the affected engine.

(g) Account for the effects of in-service deterioration, manufacturing variations, minimum material properties, and environmental effects during the tests and analyses required by paragraphs (a), (b), (c), (d), (e), and (f) of these special conditions.

(h) Propose fleet leader monitoring and field sampling programs that will monitor the effects of engine fan blade usage and fan blade retention system integrity.

(i) Mark each fan blade legibly and permanently with a part number and a serial number.

Issued in Burlington, Massachusetts, on October 30, 2015.

Colleen D'Alessandro
Manager, Engine & Propeller Directorate
Aircraft Certification Service
[FR Doc. 2015-29589 Filed: 11/19/2015 8:45 am; Publication Date: 11/20/2015]